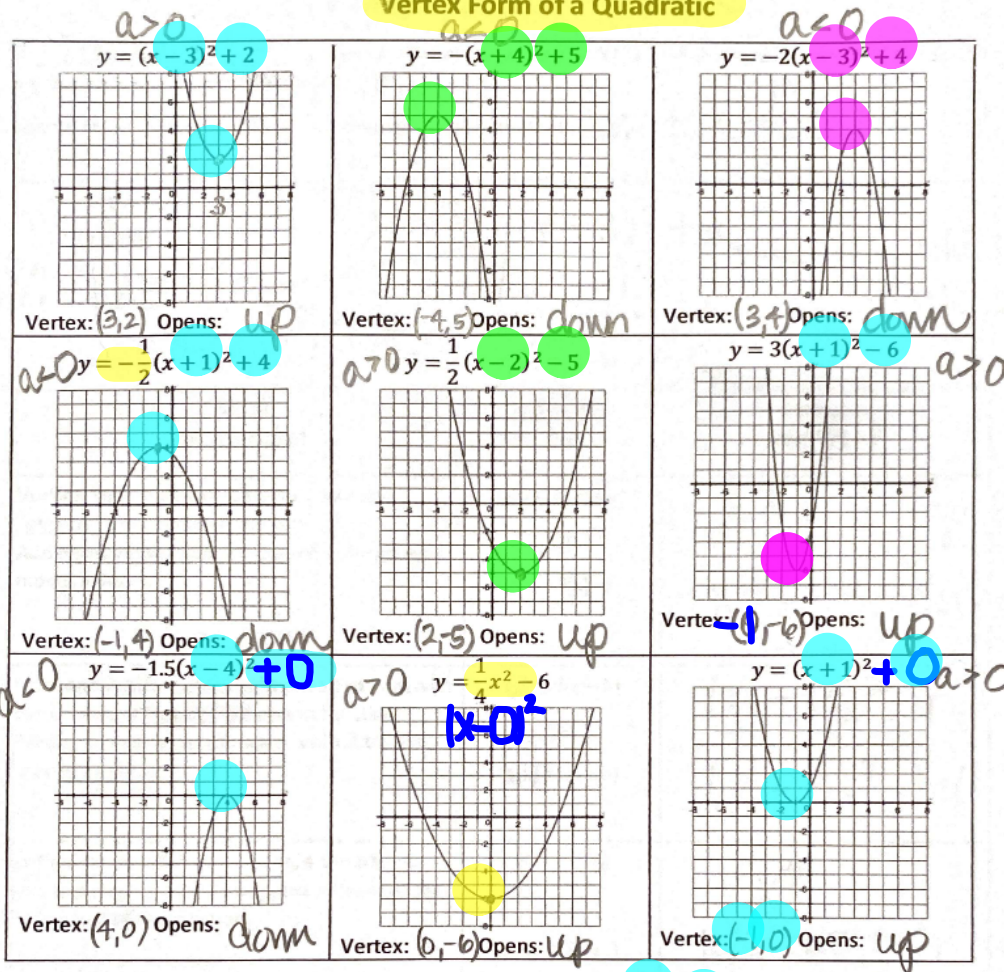


Vertex Form of a Quadratic



What patterns did you notice from the equation and the graph?

h is opposite
 k is the same

$a > 0$ up

(h, k) are the vertex
 $a < 0$ down

VERTEX FORM: $y = a(x - h)^2 + k$

Vertex: (h, k)

If $a > 0$, opens up

If $a < 0$, opens down

For the following equations, identify the vertex and whether the graph opens up or down.

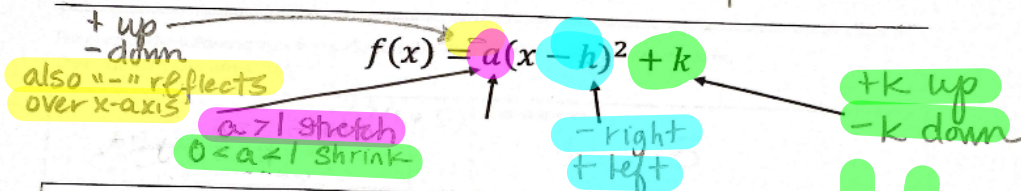
- $y = -2(x - 3)^2 + 8$
V: $(3, 8)$ Opens: down
- $y = 3(x + 2)^2 - 5$
V: $(-2, -5)$ Opens: up

- $y = 3(x + 9)^2 + 0$
V: $(-9, 0)$ Opens: up
- $y = -3.5x^2 - 7$
V: $(0, -7)$ Opens: down

Transformations of Quadratics

A parent function is the original graph of a function WITHOUT any transformations. For quadratics, the equation of the parent function is $y = x^2$.

The best form to describe the transformations of a quadratic is vertex form.



Type of Transformation	Looks Like	Examples from $f(x) = x^2$
Vertical Shift — add or subtract a constant "outside" of the parent function. Adding moves the function up and subtracting moves it down.	$g(x) = f(x) + k$ Or $g(x) = f(x) - k$	$x^2 + 2$ up 2 $x^2 - 3$ down 3
Horizontal Shift — add or subtract a constant with the x-value or "inside" the parent function. Adding moves the function left and subtracting moves it right.	$g(x) = f(x - h)$ Or $g(x) = f(x + h)$	$(x - 2)^2$ right 2 $(x + 3)^2$ left 3
Reflection over X-Axis — multiply the parent function by -1 or put a negative in front of the coefficient of the function.	$g(x) = -f(x)$ Or $g(x) = -1 \cdot f(x)$	$-x^2$ reflects over x-axis
Vertical Stretch — multiply the parent function by a constant that is greater than 1.	$g(x) = a \cdot f(x)$ $a > 1$	$2x^2$ stretch by 2
Vertical Shrink — multiply the parent function by a constant that is more than 0 but less than 1.	$g(x) = a \cdot f(x)$ $0 < a < 1$	$\frac{1}{2}x^2$ shrink by $\frac{1}{2}$

$f(x) = x^2 - 5$	Vertex: $(0, -5)$ Opens: up	Transformations: down 5
$g(x) = (x + 2)^2 + 0$	Vertex: $(-2, 0)$ Opens: up	Transformations: left 2
$h(x) = 4x^2 + 3$	Vertex: $(0, 3)$ Opens: up	Transformations: stretch by 4 up 3
$f(x) = -3x^2$	Vertex: $(0, 0)$ Opens: down	Transformations: reflect over x-axis stretch by 3
$g(x) = -\frac{1}{3}(x - 4)^2$	Vertex: $(4, 0)$ Opens: down	Transformations: reflect over x-axis shrink by $\frac{1}{3}$, right 4
$h(x) = \frac{3}{2}(x + 7)^2 + 1$	Vertex: $(-7, 1)$ Opens: up	Transformations: stretch by $\frac{3}{2}$, left 7, up 1
$f(x) = -x^2 - 6$	Vertex: $(0, -6)$ Opens: down	Transformations: reflect over x-axis down 6
$g(x) = 4.5(x + 9)^2 - 6$	Vertex: $(-9, -6)$ Opens: up	Transformations: stretch by 4.5, left 9 down 6
$h(x) = -6(x - 1)^2 + 8$	Vertex: $(1, 8)$ Opens: down	Transformations: reflects over x-axis, right 1, up 8, stretch by 6

by 6

